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(54) Title: METHOD FOR REDUCING THE NOISE IN A WOBBLE SIGNAL
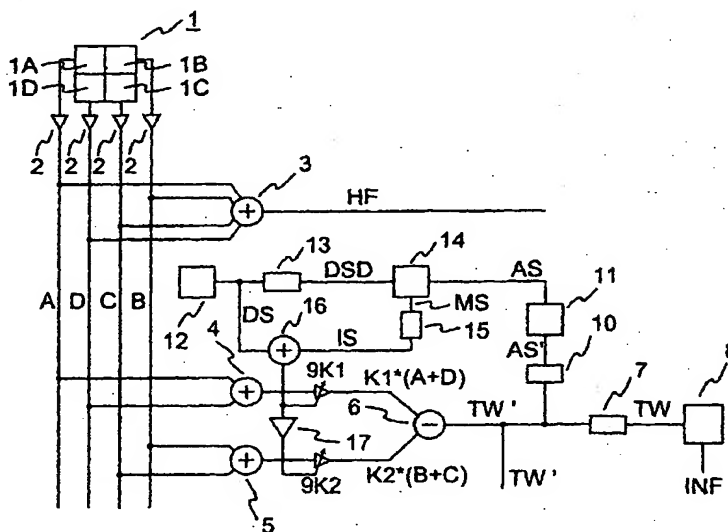
(57) Abstract: The present invention relates to a method and a circuit for recovering information (INF) contained in a wobbled track (36) on an optical storage medium (34). One aim of the invention is to describe a method within an appliance for reading from and/or writing to optical storage media (34), which can correct disturbing data signal components (AS') in the wobble signal (TW) even when the swept frequency and the lowest signal frequency are close to one another. According to the invention, this object is achieved in that the signals (A+D,B+C) from two detector halves (1A+1D,1B+1C) of a photodetector (1) which is used for reading the data contained in a track (36) on an optical storage medium (34) are provided with weighting factors (K1, K2) which are adjusted dynamically during operation of the appliance. In order to adjust the weighting factors (K1, K2), the data signal component (AS') in the wobble signal (TW) is linked to a disturbance signal (DS) from a disturbance signal generator (12).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Method for reducing the noise in a wobble signal

The present invention relates to a method and a circuit for
recovering the information contained in a wobbled track on an
optical storage medium.

Methods such as these are used, for example, in appliances for
reading from and/or writing to optical storage media with
wobbled tracks, in order to obtain address information from the
wobbled tracks and to use the wobble frequency to produce a
write clock.

In general, in optical storage media which are in the form of
discs and are suitable for reading and/or writing embossed
tracks are formed such that they represent an interleaved
spiral or concentric circles. Especially in the case of optical
storage media which are suitable for writing to, the embossed
tracks additionally have a track wobble in a specific form, in
order to find specific positions on the medium. This means that
the track is not embossed in an approximately straight line,
but in serpentine lines. In this case, by way of example, the
shape of these serpentine lines contains address information
which is used to identify a specific position on this optical
storage medium. Various methods are used for coding, examples
of which include frequency modulation or phase modulation.
Furthermore, the wobble signal may also be used for rotation
speed information or for presetting a write data rate.

Normally, the modulation shift of this track wobble is kept
small, so that there is no noticeable effect on the track
control and the read quality of the data signal. The modulation
shift is thus kept in the order of magnitude of a few percent
of the track separation. Furthermore, the modulation frequency
is designed to be in a frequency band which is typically above
the upper cut-off frequency of the tracking regulator, but is
below the lowermost signal frequency of the data signal.
However, the small modulation shift means that the signal-to-

noise ratio of the wobble signal obtained from it is relatively low. Nevertheless, the coded information and the fundamental frequency should be capable of being coded and reconstructed reliably, in order to allow reliable reading and writing.

5. Disturbance noise components must therefore be effectively suppressed.

US 5,717,679 discloses a system which is able to correct the noise components in the wobble signal resulting from any

10 eccentricity of the wobbled track. The circuit which is specified for this purpose uses variable-gain amplifiers in order to compensate for different illumination levels of two detector halves. The system is based on the CD-R technique, which uses a wobble frequency of 22.05 kHz. Since the lowest

15. signal frequency of the data signal is 934 kHz, those data signal components which are likewise present in the wobble signal can easily be removed by means of a low-pass filter, as is also disclosed in US 5,717,679. One disadvantage of this known system is that low-pass filtering is impossible when

20 using wobble frequencies which are close to the lowest signal frequency, as is the case, for example, with DVD technology (wobble frequency 825 kHz). Disturbance data signal components therefore cannot be removed with the disclosed system at high wobble frequencies.

25

One aim of the invention is to describe a method within an appliance for reading from and/or writing to optical storage media, which can remove disturbance data signal components in the wobble signal even when the wobble frequency and the lowest

30 signal frequency are close to one another.

According to the invention, this object is achieved in that the signals from two detector halves of a photodetector from which a wobble signal is obtained and which is used for reading the

35 data contained in a track on an optical storage medium are provided with weighting factors which are adjusted dynamically

during operation of the appliance. In order to adjust the
weighting factors, the data signal component in the wobble
signal is linked to a disturbance signal from a disturbance
signal generator. Dynamic adjustment of the weighting factors

5   has the advantage that the data signal components in the wobble
signal are always suppressed optimally, even if any changes
occur in the illumination level of the photodetector during
operation.

10 According to the invention, the signals from the two detector
areas of the photodetector are provided with mutually
reciprocal weighting factors. This has the advantage that the
amplitude of the wobble signal obtained from the difference
between the signals from the two detector surfaces is not

15 influenced by the weighting factors.

According to the invention, the disturbance signal is digitised
before being linked to the data signal component of the wobble
signal, so that the linking process is carried out as a

20 synchronous demodulation process. The advantage of using a
digitised disturbance signal is that the synchronous
demodulation represents multiplication by ±1, and, technically,
this can be carried out easily.

25 The wobble signal is advantageously normalized before
determining the data signal component. This may be done, for
example, by means of an averaged sum signal or the signal from
one detector half. In consequence, the amplitude of the wobble
signal is less dependent on the light power of a light source

30 in the optical scanner, or reflection on the optical storage
medium. The reaction time of the control loop to dynamic
adjustment of the weighting factors is then likewise less
dependent on these variables. One advantage of using an
averaged sum signal is that such an averaged sum signal is

35 generally already available in appliances for reading from
and/or writing to optical storage media.

In a further method according to the invention, the amplitude
of the wobble signal is kept constant, by the signals from the
two detector halves being normalized separately by means of
their respective averaged sum signal.

According to the invention, disturbance data signal components
in the wobble signal are removed by means of a circuit which
uses one of the methods mentioned above.

A method according to the invention or a circuit according to
the invention is advantageously used for recovering the
information contained in a wobbled track on an optical storage
medium in an appliance for reading from and/or writing to
optical storage media.

The invention will be explained in the following text with
reference to advantageous exemplary embodiments and using
Figures 1 to 6. Combinations of advantageous features are
likewise within the applicability area of the invention. In the
figures, identical reference symbols denote the same components
and signals. In the figures:

Figure 1:   shows an arrangement for obtaining a wobble
                   signal according to the prior art;

Figure 2:   shows an arrangement according to the invention
                   for automatic adjustment of the weighting
                   factors;

Figure 3:   shows a signal diagram to explain the method of
                   operation of an arrangement according to the
                   invention;

Figure 4:   shows an arrangement corresponding to Figure 2,
                   with the wobble signal being normalized;

Figure 5:   shows an arrangement corresponding to Figure 2,
                 with the signals of the two detector halves
                 being normalized; and

Figure 6:   shows an appliance for reading from and/or
                 writing to optical storage media, which has an
                 arrangement according to the invention for
                 automatic adjustment of the weighting factors.

Figure 6 shows an appliance for reading from and/or writing to
optical storage media 34, which has an arrangement 38 according
to the invention for obtaining information INF contained in a
wobbled track 36 on the optical storage medium. The scanning
beam 40 which is emitted from a light source 30 is collimated
by a collimator 31, and is diverted by means of a beam splitter
32. An objective lens 33 focuses the scanning beam 40 onto the
wobbled track 36 of a layer 35 of an optical storage medium 34
which carries information. The scanning beam 40 reflected from
the layer which carries the information is collimated by the
objective lens 33 and is imaged on the photodetector 1 by means
of an imaging unit 37. A tracking error signal TW' and the
information INF are obtained from the signals A, B, C, D from
the photodetector 1 by means of an arrangement 38 according to
the invention for recovering the information INF contained in
the wobbled track 36 on the optical storage medium 34. The
tracking error signal TW' is supplied to a tracking regulator
39, which itself ensures that the scanning beam 40 moves as
close as possible to the track centre of the wobbled track 36.

Figure 1 shows an arrangement for obtaining a wobble signal TW,
which is used by a decoding unit 8 to decode the information
INF contained in the wobbled track 36 on an optical storage
medium 34, according to the prior art. The basis for obtaining
the signal is the linking of the signals A, B, C, D from a
photodetector 1. This makes use of the characteristic that the

scanning beam 40 which strikes the optical storage medium 34 as shown in Figure 9 causes an effect which makes it possible to use the push-pull tracking control method. This effect is based on the principle that a diffraction effect occurs at the edges

5   of the tracks 36, so that not only is a vertical beam (zeroth order) reflected in the direction of the photodetector 1 from the memory layer 35 which carries the information, but also higher-order beams, which are not reflected precisely at right angles to the surface of the memory layer 35. In this case, an

10 objective lens 33 is generally used to collect the reflected zeroth order and $\pm 1^{st}$ order beams and to image them on a photodetector 1, which is subdivided into at least two areas 1A+1D, 1B+1C. In the process, destructive interference of different intensity is formed in the overlapping area between

15 the zeroth order and $\pm 1^{st}$ order as a function of the tracking position, and this is evaluated in the form of a tracking error signal TW'. The resultant tracking error signal TW' is thus referred to as the push-pull tracking error signal.

20 In order to obtain this tracking error signal TW', the output signals A, B, C, D from the photodetector 1 are first of all amplified by means of an amplifier or amplifiers 2, and are then linked, for example as shown in Figure 1. The photodetector 1 is typically subdivided into four areas

25 1A, 1B, 1C, 1D, in order to obtain a focusing error signal (not shown) at the same time, in addition to the tracking error signal TW'. However, in order to obtain the tracking error signal TW' using the push-pull effect, it is sufficient to subdivide the photodetector 1 into a right-hand half 1B+1C and

30 a left-hand half 1A+1D, and to subtract the output signals from these two detector halves from one another. In the case of a four-quadrant detector, this is done by first of all carrying out the logic operations A+D and B+C using two adders 4, 5. The difference signal (A+D) − (B+C) is then formed by means of a

35 differential amplifier 6. The difference signal (A+D) − (B+C) obtained in this way is then supplied to a tracking regulator

39, as the tracking error signal TW'. The tracking regulator 39
for its part ensures that the scanning beam 40 is moved as
close as possible to the track centre of a predetermined track
36.

5

In order to decode the Information INF contained in the wobbled
tracks 36 on an optical storage medium 34, or in order to form
a write clock, a wobble signal TW is supplied to a decoding
unit 8 which, by way of example, emits address information

10   and/or a write clock. The wobble signal TW is itself formed by
filtering from the push-pull tracking error signal TW', by
means of a filter 7.

On the other hand, the data signal HF which represents the

15   information content of the optical storage medium 34 is formed
from the output signals A, B, C, D from the photodetector 1 by
addition in an adder 3. In order to allow detection by addition
of the photodetector signals A, B, C, D, the information is
stored by writing light/dark contrasts or by embossing

20   so-called pits on the optical storage medium 34.

If the scanning beam 40 is following the centre of an embossed
track 36, the scanning beam 40 is reflected on the layer 35 of
the optical storage medium 34 which carries the information,

25   such that, ideally, a round light spot is imaged on the
photodetector 1, at whose sides the already mentioned
interference resulting from the push-pull effect is observed.
The total intensity of this light spot is modulated by the
brightness contrast of the area illuminated by the scanning

30   beam 40.

Since the data is stored by means of structures which cause
brightness differences, the intensity of the light spot is thus
modulated such that it corresponds to the data on the memory

35   layer 35. Ideally, this is carried out in a synchronized manner
on the two detector halves 1A+1D, 1B+1C. Since the tracking

error signal TW' and the wobble signal TW derived from it are
derived from the difference (A+D) - (B+C) between the signals
from the detector halves 1A+1D, 1B+1C the data signal component
caused by the brightness contrast is cancelled out during the

5   subtraction process by the differential amplifier 6. However,
if the imaging of the scanning beam 40 on the photodetector 1
is not ideally axially symmetrical, then a data signal
component AS' is superimposed on the desired signal component
which represents the wobbled track 36. This results in it not

10 being possible to evaluate those signal components which are
caused by the wobbled track 36 as well as before, so that
errors occur in the address evaluation.

An improvement is achieved if the weighting between the output

15 signals A+D, B+C from the two halves 1A+1D,1B+1C of the
photodetector 1 is changed before the subtraction process by
the differential amplifier 6, so that the contrast-dependent
components of the alternating light amplitudes are cancelled
out on the two halves 1A+1D, 1B+1C of the photodetector 1.

20

To this end, the four photodetector signals A, B, C, D are
first of all amplified by means of amplifiers 2. Two signal
elements A+D, B+C are then produced by summation in the adders
4, 5 and these reproduce the modulation on the respective

25 halves 1A+1D, 1B+1C of the photodetector 1. Before the
subsequent subtraction process, the signal A+D is passed
through an amplifier 9K1 with a variably adjustable gain K1, so
that the difference signal TW' is formed in accordance with the
following relationship:

30

$$TW' = K1 \times (A+D) - (B+C)$$

The weighting process results in the data signal components
which are imaged onto the detector halves 1A+1D, 1B+1C as a

35 result of the different modulation being set to the same
magnitude before the subtraction process, so that they cancel

one another out. This can also be achieved in an equivalent
manner by passing the signal B+C through an amplifier 9K2 with
a variably adjustable gain K2, corresponding to the following
signal calculation:

$$TW' = (A+D) - K2 \times (B+C)$$

The two solutions have the common feature that the resultant
amplitude of the difference signal TW' changes as a function of
the weighting factor K1, K2 setting. This can be avoided by the
two signals A+D, B+C being weighted, and by the weighting
factors K1, K2 being matched to one another such that K2=1-K1.
The following signal calculation is thus used:

$$TW' = K1 \times (A+D) - (1-K1) \times (B+C)$$

The tracking error signal TW' normally has any further
undesirable signal components, such as low-frequency
disturbances caused by residual tracking errors and so on,
removed from it by means of a filter 7, in order to obtain the
wobble signal TW which is supplied to the decoding unit 8.

During operation of the appliance for reading from and/or
writing to optical storage media 34, it is possible, however,
for a situation to occur caused by heating, ageing or other
disturbance variables in which the intensity distribution or
position of the image on the photodetector 1 changes. A
situation such as this can occur in particular as a result of
residual errors in focus control or in tracking control 39. If
the weighting factors K1, K2 are set only once during
production of the appliance, it is impossible to compensate for
such variables, which vary dynamically.

In order to overcome this disadvantage, it is advantageous to
adjust the weighting factors K1, K2 automatically during
operation such that the disturbance data signal components

cancel one another out as well as possible in the subtraction
process 6.

An arrangement according to the invention for automatic
adjustment of the weighting factors K1, K2, in which the peak
value signal AS of the data signal component AS' in the
difference signal TW' or in the wobble signal TW is determined
by means of a peak value detector 11 and is demodulated in
synchronism with the digitised disturbance signal DSD from a
disturbance signal generator 12, the result of the synchronous
demodulation is integrated and is added to the disturbance
signal DS and the result of the addition is used to adjust the
weighting factors K1, K2, is shown in Figure 2.

The difference signal TW' obtained in the manner described in
Figure 1 has low-frequency disturbances removed from it by
means of a filter 10 which passes only the data signal
frequency band, and is supplied to the input of a peak value
detector 11. The wobble signal TW can also be used instead of
the difference signal TW'. The peak value signal AS from the
peak value detector 11 is supplied to the first input of a
synchronous demodulator 14. The second input of the synchronous
demodulator 14 is supplied with the disturbance signal DSD,
digitised by a comparator 13, from a disturbance signal
generator 12. The output signal from the synchronous
demodulator 14 is integrated by an integrator 15, and is added
by means of an adder 16 to the disturbance signal DS. The
output signal from the adder 16 controls the first weighting
factor K1, while the output signal converted by a converter 17
controls the second weighting factor K2. The converter may be,
for example, a divider, an inverter, or a functional block,
which for a value x calculates the value 1-x. Of course, other
types of converters can also be used.

The invention is based on the alternating light modulations on
the two detector halves 1A+1D, 1B+1C being in phase with one

another. For this reason, the sum of the output signals
A, B, C, D from the photodetector areas 1A, 1B, 1C, 1D is used
to obtain the data signal. The voltage produced in the
photodetector 1 is in this case proportional to the intensity
5   reflected from the optical storage medium 34.

A corresponding situation applies to the two detector halves
1A+1D, 1B+1C, so that if the weighting K1, K2 is set to be the
same in the two branches during the subtraction process by
10 means of the differential amplifier 6, the data signal
components cancel one another out, provided the amplitudes are
equal. However, if there is an amplitude difference, then an
undesirable data signal component AS' remains in the difference
signal TW' after the subtraction process, and this is also
15 present in the wobble signal TW after filtering by the filter
7. The amplitude of this undesirable signal component increases
as the asymmetry of the imaging process on the photodetector 1
increases. The minimum amplitude of the data signal component
AS' can be reached by matching the weighting factors K1, K2
20 correctly.

The amplitude of the data signal component AS' is measured for
this purpose. In order to separate the data signal component
AS' from the desired wobble signal, a filter 10 which passes
25 only the data signal frequency band is advantageously inserted
between the output of the differential amplifier 6 and the peak
value detector 11. The peak value detector 11 thus measures
only the peak value signal AS of the undesirable data signal
element AS' of the difference signal TW', which is intended to
30 be minimized by correct adjustment of the weighting factors
K1, K2. This measured amplitude value AS is supplied to the
first input of a synchronous demodulator 14. The second input
of the synchronous demodulator 14 is fed with a binary signal
DSD which is once again derived from a disturbance signal DS.
35 This disturbance signal DS is produced in a disturbance signal
generator 12, and is at the same time connected to a first

summation point of an adder 16. The output of the synchronous
demodulator 14 is connected via an integrator 15 to the other
summation point of the adder 16, whose sum output itself
adjusts the weighting factors K1, K2. The method of operation
5   of this arrangement will be explained in the following text
with reference to the signal diagram in Figure 3, which shows
some of the signals under the assumption of a symmetrical
illumination of the photodetector 1. It is further assumed that
the weighting factors of both branches A+D, B+C shall be
10   K1 =K2 = 0.5.

First of all, let us assume that the output voltage from the
integrator 15 shall be a positive value relatively far away
from the optimum value 0.5. The disturbance signal generator 12
15   produces a sinusoidal or square-wave signal, which oscillates
symmetrically about zero and modulates the weighting K1, K2
between the two signal branches A+D, B+C which are supplied
from the photodetector 1 about a predetermined operating point
or a mean weighting. In this context, the term operating point
20   means that both branches have a gain of 0.5 without modulation.
When the disturbance signal DS is activated, this results, for
example, in the gain of the first branch A+D being reduced by
0.1, starting from a gain of 0.5, while the other branch B+C
has a gain of 0.5+0.1 when the disturbance signal DS actually
25   reaches its positive maximum value. The first branch A+B then
has a gain of 0.6, and the other branch B+C a gain of 0.4 at
the negative maximum value.

If the photodetector 1 is illuminated axially symmetrically,
30   the data signal component AS' in the difference signal TW' is a
minimum when the gain is 0.5 in both branches A+D, B+C. In
consequence, the data signal component AS' in the difference
signal TW' increases somewhat if the weighting factors K1, K2
are mistuned symmetrically. This increase in the data signal
35   component AS' is, however, the same for both maximum values of

the disturbance signal DS. The peak value signal AS from the
peak value detector 11 thus produces equal values in this case.

5   If the data signal components AS' in the difference signal TW',
and therefore the corresponding values of the peak value signal
AS, differ in terms of the positive and negative disturbance
amplitude, as depicted in Figure 3, it can be deduced from this
that the operating point, that is to say the weighting K1, K2
set at that time, is not optimum.

10

The analogue disturbance signal mentioned above has a
relatively small amplitude in order to keep small the increase
in the data signal component AS' in the difference signal TW'
resulting from the modulation of the weighting factors K1, K2.

15   A synchronous demodulator 14 is used in order nevertheless to
determine the correct operating point or the optimum mean
weighting K1, K2. For this purpose, the disturbance signal DS
is digitised by means of a comparator 13, and is connected to
the digital input of the synchronous demodulator 14. The

20   digitised disturbance signal DSD from the comparator 13 is, for
example, at logic "L" when the disturbance signal DS is less
than zero, and is at logic "H" when the disturbance signal DS
is greater than zero. The synchronous demodulator 14, which is
controlled by this signal DSD, multiplies the peak value signal

25   AS, which is measured by the peak value detector 11, by +1 or
-1 corresponding to the value of the digitised disturbance
signal DSD. The output of the synchronous demodulator 14
controls an integrator 15, which itself controls the first
weighting factor K1 via the first summation point of an adder

30   16, and controls the second weighting factor K2 via an
additional converter 17.

If the data signal components AS' of the difference signal TW'
are not the same for the two maximum values of the disturbance

35   signal DS, the peak value signal AS from the peak value
detector 11 in consequence supplies different values with a

difference D. These amplitude values are multiplied by +1 or -1
by the synchronous demodulator 14, whose output then supplies a
signal MS which is alternatively positive or negative and whose
magnitude corresponds to that of the measured amplitude value

5   of the data signal component AS'. The integrator 15 determines
the area integral IS of the synchronous demodulator output
signal MS and readjusts the weighting factors K1, K2 until the
measured data signal components AS' are of equal magnitude. The
arrangement thus corresponds to a control loop with an

10 integrating response, which varies the weighting factors K1, K2
until the data signal components AS' are the same for positive
and negative disturbance amplitudes.

The advantage of the control loop having an integrating

15 response is that, after a time which is dependent on the
integration time constant, the weighting K1, K2 is always set
such that the data signal component AS' in the wobble signal TW
becomes zero. The remaining residual error, that is to say in
this case the data signal component AS' in the wobble signal

20 TW, always becomes zero when using a control loop with an
integrating response. The integration time is, however,
dependent on the magnitude of the signal at the input of the
integrator 15, that is to say in the case of the weighting
factor control loop, it is dependent on the amplitude of the

25 output of the synchronous demodulator 14. This amplitude itself
depends on the amplitude of the input signal to the synchronous
demodulator 14, that is to say on the peak value signal AS from
the peak value detector, and hence on a difference signal TW'.
If, for example, the light power from the light source in the

30 optical scanner or the reflection from the optical storage
medium is halved, then the sensitivity of the difference signal
TW' and hence the output amplitude from the synchronous
demodulator 14 are halved, so that the integration time is
doubled.

35

The sensitivity of the difference signal TW' is made
independent of the light power or reflection by means of
normalization. This is achieved, for example, by normalizing
the signal TW' using an averaged sum signal, as is shown in
5 Figure 4. The averaged sum signal UIMA from the averager 18 is
supplied to a normalizer 19, which uses the sum signal UIMA to
normalize the difference signal TW'. In this case, the
integration time is less dependent on the light power from the
light source 30 in the optical scanner or the reflection from
10 the optical storage medium 34. Furthermore, such an averaged
sum signal UIMA is already present in appliances for reading
from and/or writing to optical recording media.

It is likewise possible to normalize the signals A+D, B+C from
15 the two detector halves 1A+1D, 1B+1C separately, by means of
their respective averaged sum signal, before amplification by
the variable amplifiers 9K1, 9K2 and before subtraction by the
differential amplifier 6, as is illustrated in Figure 5. The
sum signal A+D from the first detector half 1A+1D is for this
20 purpose supplied to the averager 20, whose output signal is
supplied to the normalizer 21 and is used to normalize the sum
signal A+D. In a corresponding way, the sum signal B+C from the
second detector half 1B+1C is normalized by means of the
averager 22 and the normalizer 23. The amplitudes of the
25 signals from the two detector halves 1A+1D, 1B+1C are then
completely independent of the reflection and of the light
power.

Patent Claims

1. Method for obtaining information (INF) from a wobbled track
    (36) on an optical storage medium (34) by producing a wobble
    signal (TW) from the difference between the signals from two
    photodetector areas (1A+1D,1B+1C) of a photodetector (1),
    with the signal (A+D) from one detector area (1A+1D) being
    provided with a weighting factor (K1), **characterized in that**
    a disturbance signal (DS), which is produced by a
    disturbance signal generator (12), is linked to a data
    signal component (AS, AS') which is contained in the wobble
    signal (TW, TW') and is used for automatic adjustment of the
    weighting factor (K1).

2. Method according to Claim 1, **characterized in that** the
    signal (B+C) from the other detector area (1B+1C) is
    provided with a weighting factor (K2).

3. Method according to Claim 2, **characterized in that** the
    weighting factors (K1, K2) are contrariwise.

4. Method according to Claim 3, **characterized in that** the
    weighting factors (K1, K2) depend from one another according
    to K2=1-K1.

5. Method according to one of Claims 1-4, **characterized in that**
    the disturbance signal (DS) is digitised, the digitised
    disturbance signal (DSD) and the data signal component
    (AS, AS') of the wobble signal (TW, TW') are demodulated in
    synchronism with one another, and the resultant signal is
    integrated and is added to the disturbance signal (DS).

6. Method according to Claim 5, **characterized in that** the
    wobble signal (TW, TW') is normalized.

7. Method according to Claim 5, **characterized in that** the
   signals (A,B,C,D,A+D,B+C) from the two detector halves
   (1A+1D,1B+1C) are normalized.

5 8. Method according to one of Claims 1-7, **characterized in that**
      the data signal component (AS, AS') of the wobble signal
      (TW, TW') is obtained by filtering from the wobble signal
      (TW, TW').

10 9. Method according to one of Claims 1-8, **characterized in that**
       the peak value signal (AS) of the data signal component
       (AS') of the wobble signal (TW, TW') is used for the linking
       process.

15 10. Circuit for obtaining information (INF) from a wobbled track
        (36) on an optical storage medium (34) by producing a wobble
        signal (TW) from the difference between the signals (A+D,
        B+C) from two photodetector areas (1A+1D,1B+1C) of a
        photodetector (1), with the signal (A+D) from one detector
20   area (1A+1D) being provided with a weighting factor (K1),
        characterized in that said circuit has a disturbance signal
        generator (12) for obtaining a disturbance signal (DS), and
        a logic unit (14) for linking the disturbance signal (DS)
        and a data signal component (AS, AS') which is contained in
25   the wobble signal (TW, TW'), the output signal from which
        logic unit (14) is supplied to a unit (15) for determining a
        weighting signal, which is added by an addition unit (16) to
        the disturbance signal (DS) and adjusts the weighting factor
        (K1).

30

11. Circuit according to Claim 10, **characterized in that** the
    signal (B+C) from the second detector area (1B+1C) is
    provided with a weighting factor (K2), which is set by a
    weighting signal generated by a converter (17).

35

12. Circuit according to Claim 11, **characterized in that** the
    weighting factors (K1, K2) are contrariwise.

13. Circuit according to Claim 12, **characterized in that** the
    weighting factors (K1, K2) depend from one another according
    to K2=1-K1.

14. Circuit according to one of Claims 10-14, **characterized in
    that** said circuit has a comparator (13) for digitising the
    disturbance signal (DS), a synchronous demodulator (14) for
    multiplication of the digitised disturbance signal (DSD) and
    the data signal component (AS, AS') of the wobble signal
    (TW, TW'), an integrator (15) for integration of the output
    signal from the synchronous demodulator (14), and an
    addition amplifier (16) for addition of the disturbance
    signal (DS) and of the output signal from the integrator
    (15).

15. Circuit according to Claim 14, **characterized in that** said
    circuit has an averager (18) and a normalizer (19), in order
    to normalize the wobble signal (TW, TW').

16. Circuit according to Claim 14, **characterized in that** said
    circuit has an averager (21, 23) and a normalizer (20, 22)
    in order to normalize the signals (A,B,C,D,A+D,B+C) from the
    two detector halves (1A+1D,1B+1C).

17. Circuit according to one of Claims 10-16, **characterized in
    that** said circuit has a filter (10) in order to obtain the
    data signal component (AS,AS') from the wobble signal
    (TW, TW') by filtering.

18. Circuit according to one of Claims 10-17, **characterized in
    that** said circuit has a peak value detector (11) in order to

obtain the peak value signal (AS) from the data signal component (AS') in the wobble signal (TW, TW').

19. Appliance for reading from and/or writing to optical storage media (34), **characterized in that** said appliance has a circuit according to one of Claims 10-18.
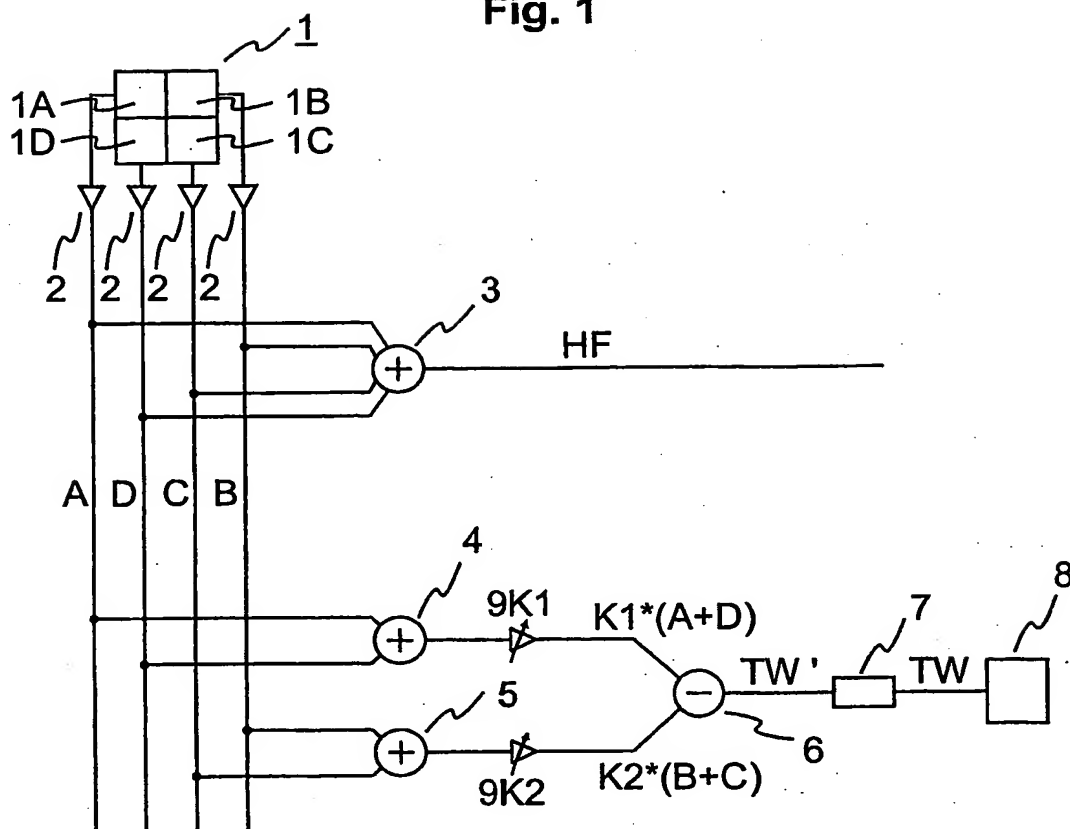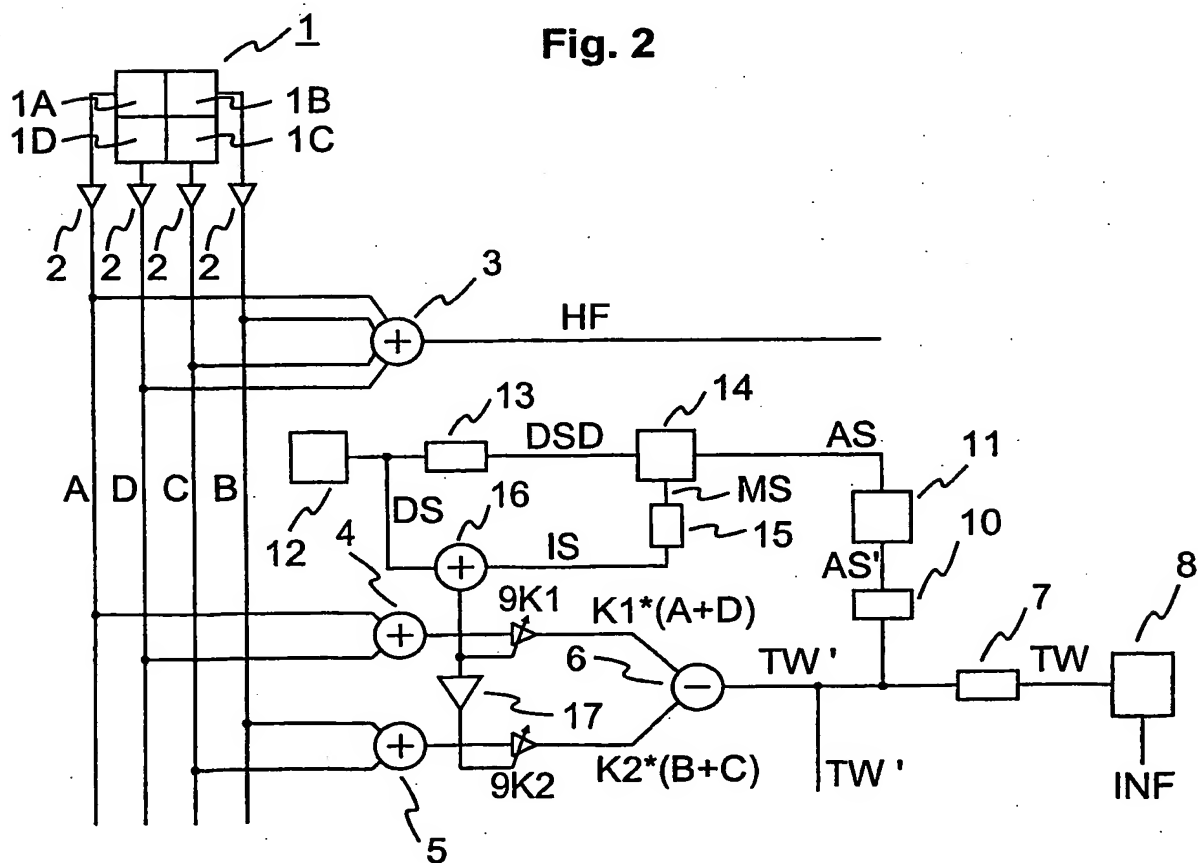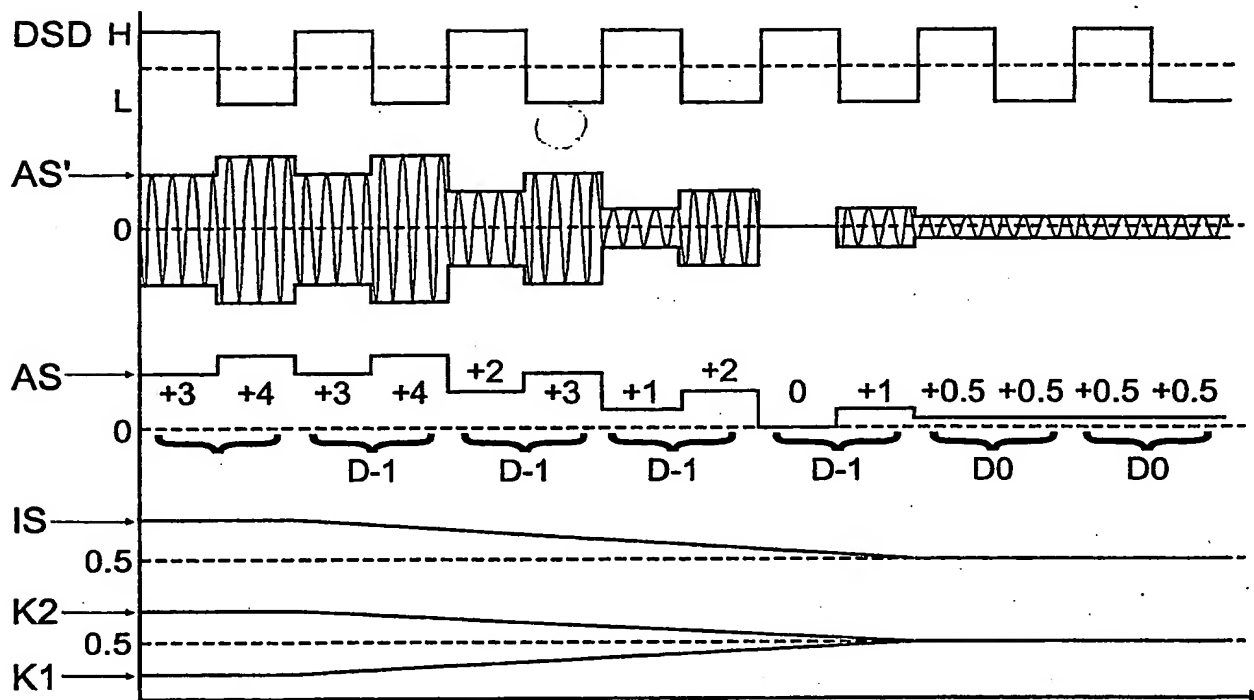
Fig. 1
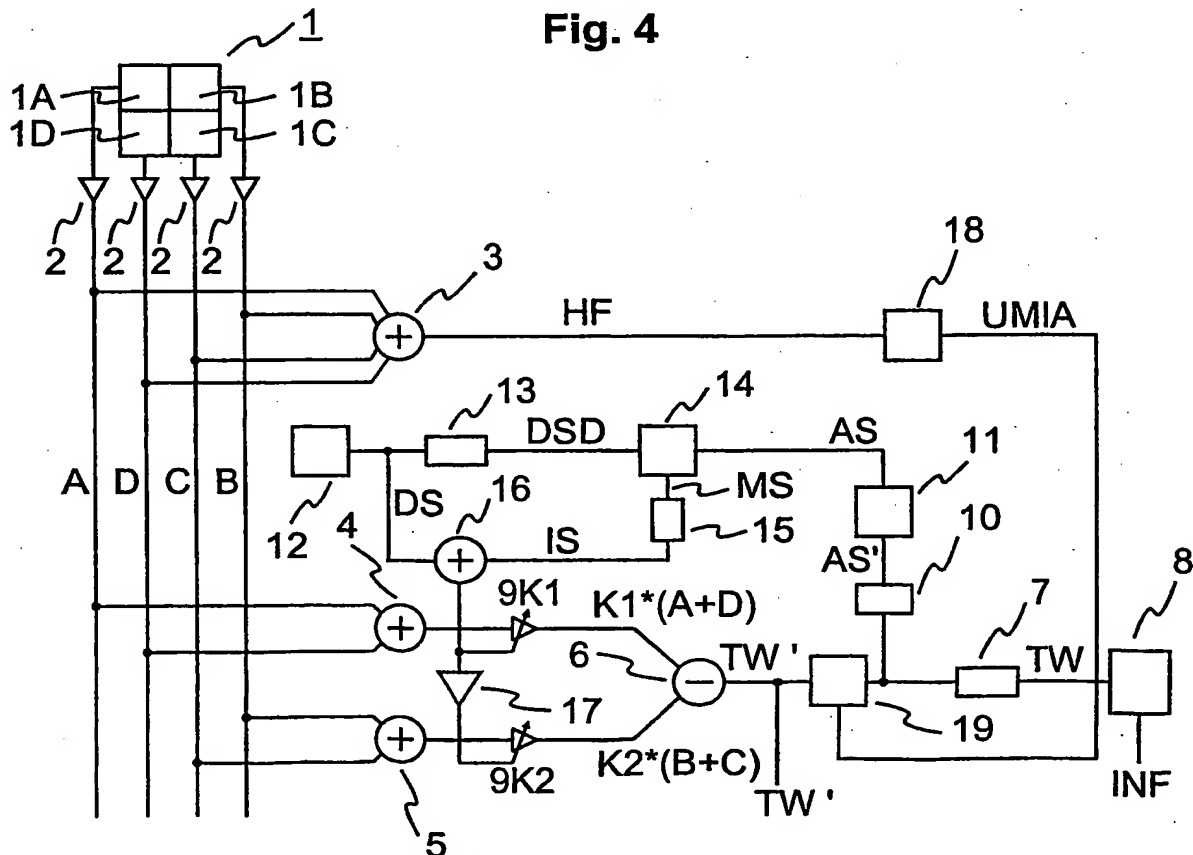
1A — 1B
1D — 1C

2 2 2 2

3

HF

A D C B

4

9K1   K1*(A+D)

7   TW

TW'

8

5

9K2   K2*(B+C)

6

Fig. 2

1A — 1B
1D — 1C

2 2 2 2

3

HF

A D C B

13   DSD   14

AS   11

12   DS   16

IS   MS   15

AS'   10

4   9K1   K1*(A+D)

6   TW'   7   TW

8

17

5   9K2   K2*(B+C)   TW'

INF

Fig. 3

Fig. 4

Fig. 5

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Fig. 6

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   G11B7/007   G11B7/00   G11B27/30   G11B27/19

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5 339 302 A (NAGAHARA SHINICHI ET AL) 16 August 1994 (1994-08-16) column 3, line 47 -column 4, line 24 ---	1-19
A	US 5 631 892 A (BAKX JOHANNES L) 20 May 1997 (1997-05-20) column 1, line 49 -column 2, line 8 ---	1-19
P,A	US 2001/026512 A1 (HIROSE KOUICHI ET AL) 4 October 2001 (2001-10-04) paragraph '0044! -----	1-19

[ ] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 November 2002	25/11/2002

Name and mailing address of the ISA	Authorized officer
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Form PCT/ISA/210 (second sheet) (July 1992)

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